

E-ISSN: 2708-0021  
P-ISSN: 2708-0013  
[www.actajournal.com](http://www.actajournal.com)  
AEZ 2020; 1(2): 37-45  
Received: 19-05-2020  
Accepted: 23-06-2020

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## Constraints and solutions of country bean (*Lablab purpureus* L.) Production: A review

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DOI: <https://doi.org/10.33545/27080013.2020.v1.i2a.17>

### Abstract

At present food-security and sustainability is a burning issue all over the world. Many indigenous food crops of Bangladesh which promises to ameliorate fruit nutritional food demand and they have the good possibility to develop the world market. Country bean is one of the most important vegetables and pulse crop which have tremendous nutritional value and this crop is cultivated round of the year. Insects, diseases, weeds and soil nutrient management were found as the major barriers for country bean production. Lack of technical knowledge and improper crop management approaches were observed to bean cultivation. To optimize the higher yield of country bean, it had to use less hazardous insecticides, fungicides, biocides, herbicides, and balanced fertilizer and bio-fertilizers in crop management practice. This review paper examined the problems and solutions for the country bean production.

**Keywords:** *Lablab purpureus*, insects, diseases, weeds, management

### Introduction

Country bean is an important vegetable-cum-pulse, food-secure and nutritious crop. Bean is a member of Leguminosae, sub-family Papilionaceae. This bean is well known as “*Sheem*” and the scientific name is *Lablab purpureus*, *Dolichos lablab* or *Dolichos niger*. It is reported to be originated in India (Sibiko *et al.* 2013; Chowdhury *et al.* 1989) <sup>[1, 2]</sup> and then spread to other parts of the world. It is grown in a significant acreage after brinjal and tomato in Bangladesh. Generally, it is also known as income generating crop in our country. It is widely grown in Cumilla, Noakhali, Sylhet, Dhaka, Kishoregonj, Tangail, Jasohore, Pabna, Dinajpur, and Cartogram intensively but for the last ten years it has been extended to Khulna and Barisal regions (Singh *et al.* 2019; Aditya, 1993) <sup>[3,4]</sup>. This crop fixes atmospheric nitrogen in a symbiotic relationship with rhizobium bacteria in the soil (Karla, 2009) <sup>[5]</sup>. It plays a big dietary role supplying proteins, carbohydrates, essential elements and vitamins to both rural and urban people. The fresh pods and green seeds are eaten boiled or are used to prepared curries, ripe seeds are also used as pulse, often as soup “*dhal*” (Sultana, 2001) <sup>[6]</sup> and mature seeds are occasionally sun-dried and stored for use as vegetables. It contains 4.2 g protein, 110 mg calcium, 4.7 mg iron, 2.4 mg vitamin A and 35 mg vitamin C in 100 g edible parts of bean (Anonymous, 2013) <sup>[7]</sup>. Protein percentage of country bean is 4.5% in green pod and 25% in dry seed and has a great demand for both young pods and mature seeds irrespective of rich and poor. It also contains significant amounts of thiamin, riboflavin, niacin, vitamin C, and iron (0.1, 0.06, 0.7, 9.0, and 4 1.7 mg/100 gm); respectively (Rehana, 2006) <sup>[8]</sup>. The green pods and developed unripe seeds serve as delicious protein rich vegetables (Wortman *et al.* 2004) <sup>[9]</sup> and antifungal protein (Ye *et al.* 2000) <sup>[10]</sup>, good source of iron and zinc (Buruchara *et al.* 2011) <sup>[11]</sup> and have a low glycemic index (Widers, 2006) <sup>[12]</sup>. However, its production is hampered due to attack of a number of insects, diseases, weeds (Specially in summer season) and cause severe damage to country bean. In view of above facts, the present study was undertaken to review the information on the effect of insect, diseases, weeds and soil nutrients of the country bean production.

### Methodology

To assess the current state of the research on insects and diseases of country bean, a review of the existing journal literature, books, report, blogs and newspaper were carried out.

Keywords: (*Lablab purpureus*, insects, diseases, weeds, management) search in the google, google scholar, research gate ([www.researchgate.net](http://www.researchgate.net)), web of science database ([www.thomsonreuters.com/web-of-science](http://www.thomsonreuters.com/web-of-science)) and a full-text search of the Science Direct ([www.sciencedirect.com](http://www.sciencedirect.com)) database were carried out. Information was also collected from government organization and NGO's by personal communication.

### The Country Bean Yield Loss Topology and Assessment

Country bean yield losses may be caused by abiotic and biotic environmental factors, leading to the reduction of crop performance and resulting in a lower actual yield than the site-specific attainable yield/production of crops. The study revealed that the adverse abiotic factors (precipitation, temperature and nutrients) and biotic factors (harmful insect, weeds and diseases) was responsible to reduce the country bean production (Figures 1). The abiotic and biotic factor effects in country bean ecosystem were in decreasing ranked order of yield, diseases (20-100%)> harmful insect (20-45%)> weeds, (15-145%)> soil nutrients (10-20%)> and environmental factors (10-15%); respectively [Figure 2, and Table 1].

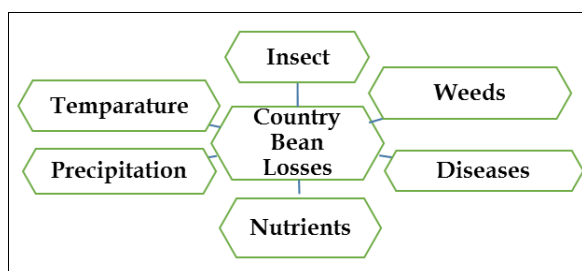


Fig 1: Abiotic and biotic factors causing country bean yield losses

Table 1: Review of literature on the barrier and yield loss (%) rank of country bean production

| Items                | Yield-loss (%) | References   |
|----------------------|----------------|--|
| Insect               | 20-45          | (Singh and Allen, 1980, Ochilo <i>et al.</i> , 2011; Uddin <i>et al.</i> 2014) <sup>[13, 14, 15]</sup> . |
| Diseases             | 20-100         | (Singh and Schwartz, 2010) <sup>[16]</sup> .   |
| Soil Nutrients       | 10-20          | (Margaret <i>et al.</i> 2014) <sup>[17]</sup> .  |
| Weeds                | 15-45          | (Issue, 2019; Soltani <i>et al.</i> 2013) <sup>[18, 19]</sup> .  |
| Environmental factor | 10-15          | (Pagiola, 1995; Abate and Ampofo, 1996) <sup>[20, 21]</sup> .  |

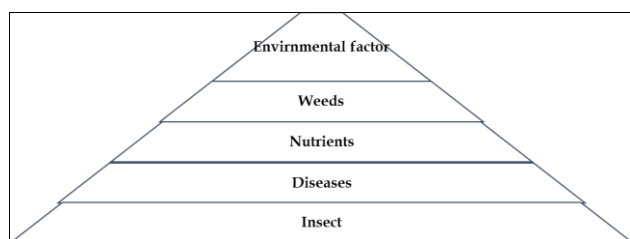


Fig 2: The Pyramid shows the factors due to country bean yield loss

### Insect Pests of Country Bean

In Bangladesh, Begum (1993) <sup>[22]</sup> observed many insects that attacked country bean field. Among them aphid was the most important and others were beetle, pod borer and mites. Khan *et al.* (2018) <sup>[23]</sup> observed five insect species were found, among them aphid (*Aphis craccivora* Koch), pod borer (*Maruca testulalis* G.) and epilachna beetle

(*Epilachna dodecastigma*) were recorded in both seasons. Shoot borer (*Acrobasis caryae*) and field cricket (*Brachytrypes portentosus*) were also found in winter and summer season, respectively in Sylhet. In Bangladesh (Table 2) the major insect and mite pests of country bean incidence of bean were aphid (*Aphis craccivora*), pod borers (*Maruca testulalis* G. and *Helicoverpa armigera*), leaf paster (*Hedylepta indicata* Fb), leaf beetle (*Sagra carbunculus* Hope, *S. femorata* Dmry), leaf weevil (*Blosyrus oniscus*, *Alcides collaris* P.), hooded hopper (*Leptocentrus taurus* Fb.), lablab Bug (*Coptosoma cribrarium* F.), leaf eating caterpillar (*Plusia orichalcea* Fb.), leaf miner (*Cosmopterix* sp.) and red mite (*Tetranychus* sp.) (Karim 1995; Jayasinghe *et al.* 2015) <sup>[24, 25]</sup>. Das *et al.* (2014) <sup>[26]</sup> noted frequency of five key insects and mite infested of bean field in Bangladesh. These were aphid (*Aphis craccivora* Koch), flower bud and pod borer (*Maruca testulalis* G.), leaf miner (*Cosmopterix* sp.), leaf past (*Hedylepta indicata* F.) and one mite (*Tetranychus* sp.). Khan *et al.* 2020 <sup>[27]</sup> observed that the aphid and pod borer significantly positive relationship with number of pods of country bean and temperature in Sylhet. Islam (1999) <sup>[28]</sup> recorded aphid (*Aphis medicaginis* Koch), leaf paster (*Hedylepta indicata* Fb), leaf miner (*Cosmopterix* sp.), pod borer (*Maruca testulalis* G.), bug (*Coptosoma cribrarium* F.), hooded hopper (*Leptocentrus Taurus* Fb.), mite (*T. etranychus* sp.), leaf beetle (*Sagra carbunculus* Hope, *S. femorata* Drury), leaf weevil (*Blosyrus oniscus*, *Alcides collaris* P), leaf eating caterpillar (*Plusia orichalcea* Fb.) from country bean in on-station study. Alam (1969) <sup>[29]</sup> informed bean suffers from damages caused by nine different insect species and one species of mite. Four of these species such as aphid (*Aphis medicaginis* Koch), bean bug (*Coptosoma cribrarium* F.), leaf miner (*Cosmopterix* sp.) and mite (*Tetranychus* sp.) have been considered as major pests. Leaf miner had been recorded first to infest country bean leaves during 1963 in Dhaka farm. He also found green semilooper (*Plusiaorichalcea*), hooded hopper (*leptocentrus taurus* Fb.), shoot borers (*Sagra carbunculus* H. and *Sagra femorata* D.), shoot weevil (*Alcides collaris* P.), leaf weevil (*Blosyrus oniscus*), epilachna beetle (*Epilachna dodecastigma*) and shoot borer (*Acrobasis caryae*) as the minor pests. Khan *et al.* 2019 <sup>[30]</sup> observed that the infested pod and infested pod weight range from (1.91 to 10.37) % and (1.31 to 11.37) kg/plot during winter and summer season in Sylhet, Bangladesh.

In India, bean crop has been reported to be censured by more than 57 species of arthropods (Govindan, 1974; Ram *et al.* 2016) <sup>[31, 32]</sup>. About 30 species of insects have been reported damaging Indian bean. The major pests include aphids, sap-sucking bugs, pod borers, leaf miners and stem fly (Das *et al.* 2014) <sup>[26]</sup>. The major insect to common bean is stem maggot and aphid which cause the yield loss of about 37% to 100% and 37% Ochilo *et al.*, (2011) <sup>[14]</sup>. The galerucid beetle (*Madurasia obscurella* Jacoby) has been reported as an important insect of kharif pulses by Saxena (1976) <sup>[33]</sup>. In Africa, (Abate and Ampofo, 1996; Singh, 1983) <sup>[21, 34]</sup> reported that more than 30 insects attack country bean and the pest were leaf eating blue (*Ootheca bennigsenni* Wse.), green beetles (*Hallirhotius africana* Jac.), bean stalk borer (*Chryptophlebia semilunana* Sal.), american boll worm (*Heliothis armigera* Hb.), striped weevil (*Alcidodes leucogrammus* Erichson), pollen beetle (*Mylabris* spp.), army worm (*Spodoptera* spp.), spiny brown

bugs (*Acanthomia* spp.) bean fly (*Melanagromyza phaseoli* Tryon), black bean aphid (*Aphis fabae*), pod borer (*Maruca testulalis* G.) and many species of thysanopterous, orthopterous and acaridorous as the minor insects.

### Diseases of Country Bean

The bean diseases effect on healthy beans production Keikotlaile and Spanoghe, (2011) [35]. Soil-borne diseases caused by fungi continue to be a threat in production of beans and so that smallholder farmers practice field hygiene, use certified seeds, carry out crop rotation and apply recommended pesticides (Monda *et al.* 2003) [36]. Many organisms involved bacteria, viruses and parasites (Rover, 1998) [37] to spared bean diseases in bean field agroecosystem.

More than 454 diseases in about 100 cultivated crops have

so far been noted in Bangladesh (Anonymous, 2008) [38]. From chorogram, 24 diseases with their incidence and severity were recorded in farmers' field (Hossain *et al.* 2010) [39]. Among them country bean is a very important crop in Bangladesh as cultivated in whole year. From the Table 2, the list of country bean diseases in Bangladesh as cercospora leaf spot of bean (*Cercospora cruenta*), foot and root rot bean (*Fusarium oxysporum*, *Rhizoctonia solani*, *Sclerotium rolfsii*), leaf rot (*Sclerotinia sclerotiorum*), wilt of bean (*Fusarium oxysporum*, *Pythium sp.*, *Sclerotium sp.*, *Rhizoctonia sp.*), powdery mildew (*Oidium sp.*, *Erysiphe polygony*), asian bean rust/rust bean (*Uromyces ciceria*, *U. phaseoli*), bean common mosaic-virus (Vet-Aphid), leaf blight (*Leptosphaerulina trifoli*), blight disease of gram (*Ascochyta rabiei*) were observed in bean field.

**Table 2:** Review of literature on the major insects and diseases of country bean field

| Insects                 | References  |
|-------------------------|---|
| Aphid                   | Ochilo <i>et al.</i> , 2011; Khan <i>et al.</i> 2018; Jayasinghe <i>et al.</i> 2015; Das, 2014; Ram <i>et al.</i> 2016; Prabal, 2000; Bahar, 2007; Das <i>et al.</i> 2008; Jahan <i>et al.</i> , 2013 [14, 23, 25, 26, 32, 40, 41, 42, 43]. |
| Pod borers              | Khan <i>et al.</i> 2018; Jayasinghe <i>et al.</i> 2015; Ram <i>et al.</i> 2016; Huang, 2001; Huang, 2003 [23, 25, 32, 44, 45].  |
| Leaf beetle             | Karim 1995; Jayasinghe <i>et al.</i> 2015 [24, 25].   |
| Epilakhna beetle        | Khan <i>et al.</i> 2018; Karim 1995; Jayasinghe <i>et al.</i> 2015 [23, 24, 25].  |
| Shoot borer             | Khan <i>et al.</i> 2018; Karim 1995; Jayasinghe <i>et al.</i> 2015 [23, 24, 25].  |
| Leaf weevil             | Islam 1999; Yusuf, 1998; Ogunsina, 2011 [28, 46, 47].   |
| leaf eating caterpillar | Jayasinghe <i>et al.</i> 2015; Ameh, and Okezie, 2005 [25, 48].   |
| leaf miner              | Jayasinghe <i>et al.</i> 2015; Das <i>et al.</i> 2014; Islam 1999; Ram <i>et al.</i> 2016 [25, 26, 28, 32].   |
| red mite                | Jayasinghe <i>et al.</i> 2015; Islam 1999; Alam 1969 [25, 28, 29].  |
| Hooded hopper           | Islam 1999; Uddin <i>et al.</i> 2013 [28, 49].  |
| Bug                     | Jayasinghe <i>et al.</i> 2015; Islam 1999; Ram <i>et al.</i> 2016 [25, 28, 32].   |
| Diseases                | References  |
| Cercospora leaf spot    | Hawthorne <i>et al.</i> 2004; Egan <i>et al.</i> , 2006; Kimber <i>et al.</i> 2007; Richardson, 2008 [50, 51, 52, 53].  |
| Anthrachnose            | Mulanya <i>et al.</i> , 2014 [54].  |
| Foot and root rot       | Allen 1995; Muthomi <i>et al.</i> 2007; Muthomi <i>et al.</i> 2014 [55, 56, 57].  |
| Leaf rot                | Genchev and Kiryakov 2002; Navarro and Nienhuis. 2008 [58, 59].   |
| Angular leaf spot       | Mulanya <i>et al.</i> , 2014 [54].  |
| leaf blight             | Shakir <i>et al.</i> 1999; Ward <i>et al.</i> 2008; Madgwick <i>et al.</i> 2011; Webb <i>et al.</i> 2011 [60, 61, 62, 63].  |
| Wilt                    | Muthomi <i>et al.</i> 2007; Muthomi <i>et al.</i> 2014; Nguyen and Ranamukhaarachchi 2010 [56, 57, 64].   |
| Powdery mildew          | Da Silva <i>et al.</i> 2003 [65].   |
| Rust                    | Mulanya <i>et al.</i> , 2014 [54].  |
| Common mosaic-virus     | Beaver, 2004; Beaver <i>et al.</i> 2005 [66, 67].   |
| Root gall               | Ameh and Okezie, 2005; Agu, 2008 [48, 68].  |

The list of some disease caused by pathogens in African country bean includes; *Oidium spp*, *Phoma spp* and *Aecidium spp*. They have been identified as effective pathogens causing powdery mildew, leaf spot and stem rust respectively. Wilting leaf mosaic and root gall have equally been identified as diseases in African country bean (Ameh and Okezie, 2005; Agu, 2008) [48, 68]. Production of beans in Kenya is also severely forced by foliar diseases namely angular leaf spot, anthracnose and rust (Mulanya *et al.*, 2014) [54]. Anthracnose (*Colletotrichum lindemuthianum*), angular leaf spot (*Phaeoisariopsis griseola*), ascochyta blight (*Phoma exigua* and *Ascochyta phaseolorum*), powdery leaf spot (*Mycovellosiella phaseoli*), cercospora leaf spot (*Cercospora cruenta*), scab (*Sphaceloma* state of *Elsinoe phaseoli*), web blight (*Thanatephorus cucumeris* or *Rhizoctonia solani*), white mould (*Sclerotinia sclerotiorum*), bean common mosaic virus (BCMV) vector-aphid, bean yellow mosaic (BYMV) vector-aphid, common bacterial blight (*Xanthomonas campestris* pv. *Phaseoli*), charcoal rot (*Macrophomina phaseolina*), fusarium wilt or vascular wilt (*Fusarium oxysporum* f.sp.), halo blight (*Pseudomonas*

*syringae* pv. *phaseolicola* and pv. *Syringae*), root rots complex of root and stem rots (*Phythium spp.*, *Rhizoctonia solani*, and *Fusarium solani*) and fungal alpha-amylases diseases found in African bean field Allen (1995) [55].

### Weeds of country bean

Weeds have been a persistent problem for farmers ever since beginning of agriculture because it causes economic losses by reductions in crop yields and quality, increase costs of crop production (Bhuler *et al.* 1998) [69]. Weed interference can result in large yield losses in as much as 58 to 99% (Dawit *et al.* 2011; Mukhtar, 2012) [70, 71] and 20-70% in bean and also interfere with harvest operations and may stain white bean, resulting in reduced market value (Abiye and Fasil, 2009; Urwin, 1999) [72, 73].

Some weeds such as smooth crabgrass (*Digitaria ischaemum*), large crabgrass (*Digitaria sanguinalis* L.), Bathua (*Chenopodium album* L.), wild radish (*Raphanus raphanistrum*), common groundsel (*Senecio vulgaris*), buttonweed (*Abutilon theophrasti* Medic.), bish katali (*Polygonum persicaria* L.), wild mustard (*Sinapis arvensis*

L.), and common chickweed (*Stellaria media*) were observed in bean field (Senseman, 2007; Omafra, 2011) <sup>[74, 75]</sup>. The severe growing of weed impact the bean yield (Esmaeilzadeh and Aminpanah, 2015) <sup>[76]</sup>.

### Soil Nutrient of Country Bean

Crop cannot exist without continuous supplies in adequate amounts of all essential nutrients. If even one nutrient is limiting or missing from the nutrient medium or diet of a plant in field, the plant will suffer and ultimately die. Summer country bean is anew introduced vegetable crop in our country. The bean yield is low (Khan *et al.* 2019) <sup>[30]</sup> of summer in Bangladesh as compared to the other nations of the world. The reasons of lower yield can be attributed to imbalanced use of fertilizer, growing more weed, not managed crop rotation, limited use of micro nutrients and so the organic matter decrease day by day from cultivated land. To recover the problem, the farmers mainly use N, P and K for crop production. In bean field boron and molybdenum fertilizer need to equilibrium influence three (N, P, K) macronutrients (Margaret *et al.* 2014; Raj, 1985) <sup>[17, 77]</sup> and help in protein synthesis and fixation of atmospheric nitrogen in the root of legume by nodule bacteria. Singh *et al.* (2008) <sup>[78]</sup> reported that application of molybdenum alone or combination with *S. rhizobium* significantly increased the grain of black gram in bean field.

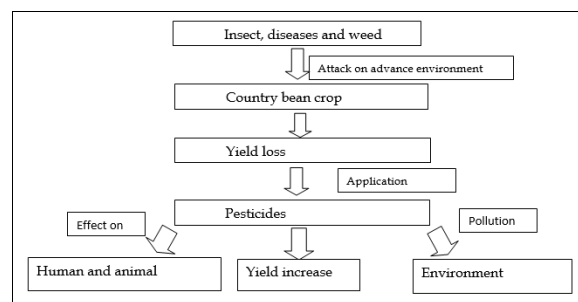
### Management of Barriers for Successful Yield Production

Bangladeshi farmers mainly apply insecticides and a little number of herbicides, fungicides, acaricides and rodenticides (Gain *et al.* 1998) <sup>[79]</sup> in the vegetable field in the form of granules, liquid and powder. It has been stated that 20 insecticides, 18 fungicides and 2 rodenticides, are being used in Bangladesh (Sattar, 1958) <sup>[80]</sup>. The key pesticides used by the farmers are Cypermethrin, Dichlorvos, Malathion, Carbofuran, Mancozeb and Diazinon depending upon the invading pests in Bangladesh (Ali, 2002) <sup>[81]</sup>. Besides, many pesticides used in Bangladesh are in the banned or restricted list under international agreements (Novib, 1993; Meisner, 2004; SUNS, 1998; SOS, 2004) <sup>[82, 83, 84, 85]</sup>. Insect managing is nowadays a worldwide ecological task mainly due to environmental pollution caused by widely used of synthetic chemical pesticides (Rattan, 2010) <sup>[86]</sup>. Pesticides are human-made and naturally occurring chemicals that control insects, diseases and weeds that damage the crop (Xiao *et al.* 2010; Clarke *et al.* 1997) <sup>[87, 88]</sup>. Synthetic pesticides have been used since 1945 in order to reduce crop harms due to plant pathogens. However, the use of pesticides has some detrimental penalties on environment, such as groundwater pollution, river eutrophication, soil erosion, excessive water use and the development of weeds and diseases resistant to chemical control (Lichtfouse *et al.* 2009) <sup>[89]</sup>. The harmful pesticides are melted in our water system and finally enter into the human ecosystem, fishes, many other animals and cause severe damage to their health (Khandakar, 1990) <sup>[90]</sup>. Furthermore, chemical pesticides as like as fertilizers contain heavy metals which were polluted the environment (Yusuf *et al.* 2003) <sup>[91]</sup>. Many chemical pesticides were used to control insects, diseases, weeds but it's advance hazardous for plant, animal and environment for that's why we were not including about chemical insecticide. Besides, botanical and bio-rational pesticides can be suggested as an environmentally safe, water soluble, less persistent, less risk

to apply in the presence of natural enemies and more toxic to pests compared to those of earlier first and second-generation pesticides in the management of agricultural insect, diseases and weeds of country bean field. Figure 3 indicate that solely used pesticides for controlling insects, diseases and weeds have a lot of detrimental effects on the environment and human health although these interventions increased the crop production. They are also easily biodegradable nature, systematic after application, capacity to alter the behavior of target insect, diseases, weeds and favorable for the evergreen revolution of the world.

**Azadirachtin:** Azadirachtin comprising neem (*Azadirachta indica*) seed extracts cause various effects in insects. The neem tree leaf, bark and seeds contain many substances with insecticidal properties. They act as antifeedants, growth regulators and sterlant. The effect upon insect development is most important from the viewpoint of practical insect control. Bioneem is a purely neem based water soluble mollifiable concentrate developed indigenously (Martineau, 1994; U.S. Environmental Protection Agency, 1993) <sup>[92, 93]</sup>. At early pod development stage, the neem oil was managed of larva of bean pod borer and aphid in 14.75 and 4.00 (No./plant) @ 4 ml/L of water at 7 days interval (Akter *et al.* 2013) <sup>[94]</sup>.

**Imidacloprid:** Imidacloprid is secondhand to control sucking insects, termites, some soil insects, and fleas on pets. It has been used in crops vended in the United States since 1914 (Gervais *et al.* 2010) <sup>[95]</sup>. The imidacloprid insecticide was considered to control of aphids, wireworms, thrips and broad bean weevil (Kaniuczak and Matosz, 1998) <sup>[96]</sup>. The insecticide effectively managed the bean leaf roll virus, bean necrotic yellows virus and soybean dwarf virus (Makkouk and Kumari, 2001; Al-Jallad *et al.* 2007) <sup>[97, 98]</sup>. It was also effective on leaf miner (*Liriomyza huidobrensis*, Blanchard) and suppressed its parasitoid (*Diglyphus isaea*, Walker) (Chen *et al.* 2003) <sup>[99]</sup>.



**Fig 3:** Flow chart about unsustainable management appraises pesticide

**Spinosad:** Spinosad is a biologically derived insecticide produced via fermentation culture of the actinomycete soil bacterium, *Saccharopolyspora spinosa*, a bacterial organism isolated from soil. The active elements in spinosad, 'spinosyn A and spinosyn D' are composite biological compounds made by soil microbes. Spinosad is a broad-spectrum pesticide but is only active if downed or contacted while in liquid form, so has little residual effect on most beneficial species (Nailah *et al.* 2009; Thompson *et al.* 2000) <sup>[100, 101]</sup>. In Australia, spinosad used as biocontrol agents, used against *Helicoverpa* spp. while conserving beneficial insects (Thompson *et al.* 2000) <sup>[101]</sup>.

**Chlorfenapyr:** Chlorfenapyr is a pesticide and specifically a pro-insecticide (meaning it is metabolized into an active insecticide after entering the host) derived from a class of microbially produced compounds known as halogenated pyrroles (Oliver *et al.* 2010) <sup>[102]</sup>.

**Sex pheromone:** Sex pheromones is composed of linear fatty acid-derived compounds, 12–18 carbons in chain length major group (type I), with an oxygenated functional group and one to three double bonds. A second major class (type 2) of sex pheromones is built on hydrocarbons through a polyene and/or epoxide practical cluster. This class of pheromones is typically start in four large moth families, the Geometridae, Noctuidae, Arctiidae, and Lymantridae (Byer, 2006) <sup>[103]</sup>. The polyene type is biosynthesized from food derived linoleic or linolenic acids and characterized by 17–23 carbon chains with 1–4 double bonds, and 0–2 epoxides (Millar, 2000) <sup>[104]</sup>. The location of the males towards the females is supposed to be mediated by a female (Pizano, 1991) <sup>[105]</sup>, since traps covering virgin females have wedged up to 192 males (Roccia, 1977) <sup>[106]</sup> however decisive proof has been absent.

**Microbial insecticides:** Microbial insecticides containing *Bacillus thuriangiensis* gram-positive pore-forming soil bacterium cause of the acute and often lethal disease anthrax. It is used as insecticides as environment friendly as an alternative conventional chemical pesticide for almost 60 years but in our country, it's a new concern use as pesticides. It is a biological warfare agent. Virulent forms of *B. thuriangiensis* harbor two plasmids, pXO1 of 181kb and pXO2 of 93.5 kb which recently have been completely sequenced (Okinaka *et al.*, 1999; Thorne, 1993) <sup>[107, 108]</sup>. *Bacillus thuringiensis* ssp. is used in beans to manage lepidopteran larvae, including *Helicoverpa* spp., diamondback moth and *Chrysodeixis* loopers (Anonymous 2008) <sup>[38]</sup>.

**Integrated pest management:** The concept of Integrated pest management (IPM) is becoming more and more popular among farmers, researchers, and policy makers in Bangladesh. In IPM, a range of methods are used for pest, diseases and weed control. IPM seeks to lessen trust on pesticides by highlighting on the contribution of other control methods, including biological control, resistance plant breeding, and cultural techniques. Furthermore, IPM is as “magic bullets” places less emphasis on expensive pesticides and more on renewable technologies available to the resource-poor farmer, such as biological control and host plant resistance, it is more possible for these farmers to share the benefits of this approach but many different things to many different people (Waage, 1998) <sup>[109]</sup>. The IPM way it is actually conducted in the majority of crop systems today still places emphasis on single technologies such as the use of pesticides, biocontrol, or host plant resistance and rarely considers the interactions among them (Thomas and Waage, 1996) <sup>[110]</sup>.

**Biological control of weeds:** Generally, in bean field weeds are manage in winter bean. In summer, there is growing loss of weed and it's a laborious work to control weed. Harris (1988) <sup>[111]</sup> defined biocontrol of weeds as the use of undomesticated organisms that feed on the weed for the purpose of reducing its density, vigor, or reproduction. Quimby, 1990 <sup>[112]</sup> said that planned use of living organisms

to reduce the vigor, reproductive capacity, density, or effect of weeds. The agricultural sector can develop various methods like as introduction of exotic biocontrol agents; increase of native biocontrol agents (herbicides); grazing systems and positive conditioning that enable livestock of various classes to eat the weeds. Grazing is desirable forage in ways that help keep weeds in check; aversion conditioning of livestock to avoid palatable poisonous weeds; and the use of superior, fast-growing forages that can successfully compete with troublesome weeds.

### Safety Food

Bangladesh has made substantial evolution towards achieving its goal of food grain self-sufficiency. This achievement has been based on a considerable intensification of agriculture. Agricultural farming activities are mainly occurring of rural in Bangladesh. Most of the people here depend on agriculture. Agriculture sector contributes about 14.49% to GDP (BER, 2018) <sup>[113]</sup>. The agriculture sector comprises crops (10.11%) of the GDP was derived from crops (BER, 2018) <sup>[113]</sup>. Ensuring food security for the enormous population of Bangladesh is directly related with the agricultural development in the country. Bangladesh is predominantly an agrarian country and having an area of 1, 47,570 km<sup>2</sup> is inhabited by 160.295 million people 22% of whom live below the national poverty line of US \$2 per day and the population density per km<sup>2</sup> is 1078 (BER, 2018) <sup>[113]</sup>. In addition, child malnutrition charges are presently at 48%, in complaint that is tied to the low social rank of women in Bangladeshi society. To alleviate poverty and malnutrition in our country it is necessary to enlarge production and feasting of nutritious and health-promoting vegetables.

### Market Price of Country Bean

The marketable price is varying from time to time, place to place, market to market and season to season (Arshad and Zainalabidin, 1994) <sup>[114]</sup>. Summer country bean price is more than the winter bean. The country bean price range 30 to 100 tk/kg in both season survey from local two market in East-Northern part, Bangladesh. The BCR of country bean yield was 2.003 where was the gross returns 483500/- tk in Bangladesh in 2014 (Chowdhuri *et al.*, 2014) <sup>[115]</sup>.

### Conclusion

The significance of increased country bean production faces abiotic and biotic problem in country bean agroecosystem. In recent years, chemical insecticides applied in bean field which were hazard for the animal, plant and environment in recent years, chemical insecticides applied in bean field which were hazard for the animal, plant and environment. Accordingly, bio-rational and botanical insecticides application have increased to consider the environment issue.

**Author Contributions:** A.U.K. and M.A.R.C. were planned, structured, wrote, and revised the manuscript thoroughly. M.S.A.T., M.S.H., S.A., T.A., and M.E. contributed to the help in writing and revision of the manuscript.

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